07 - 10 September 2009

PROCEEDINGS

54. IWK

Internationales Wissenschaftliches Kolloquium
International Scientific Colloquium

Information Technology and Electrical Engineering - Devices and Systems, Materials and Technologies for the Future

Faculty of Electrical Engineering and Information Technology

Startseite / Index:
http://www.db-thueringen.de/servlets/DocumentServlet?id=14089

TECHNISCHE UNIVERSITÄT
ILMENAU

Impressum

Herausgeber: Der Rektor der Technischen Universität Ilmenau
Univ.-Prof. Dr. rer. nat. habil. Dr. h. c. Prof. h. c.
Peter Scharff

Redaktion: Referat Marketing
Andrea Schneider

Fakultät für Elektrotechnik und Informationstechnik
Univ.-Prof. Dr.-Ing. Frank Berger

Redaktionsschluss: 17. August 2009

Technische Realisierung (USB-Flash-Ausgabe):
Institut für Medientechnik an der TU Ilmenau
Dipl.-Ing. Christian Weigel
Dipl.-Ing. Helge Drumm

Technische Realisierung (Online-Ausgabe):
Universitätsbibliothek Ilmenau
ilmedia
Postfach 10 05 65
98684 Ilmenau

Verlag:
Verlag ISLE, Betriebsstätte des ISLE e.V.
Werner-von-Siemens-Str. 16
98693 Ilmenau

ISBN (USB-Flash-Ausgabe): 978-3-938843-45-1
ISBN (Druckausgabe der Kurzfassungen): 978-3-938843-44-4

Startseite / Index:
http://www.db-thueringen.de/servlets/DocumentServlet?id=14089

Eddy current method of molten steel surface testing in thin slab casting process

Katankin R.A., Pokrovskiy A.D.

During the thin casting process it is necessary to follow the liquid steel level in a mould. Now the liquid steel level is estimated by a gamma ray method. An eddy current build-in molten metal level sensor doesn't use now. It is necessary to create such a molten metal level sensor which will be answer the purpose of the human health and measure the molten metal level efficiently.

Terms - casting process, liquid steel level, mould, eddy current, molten metal, sensor

During the thin casting process it is necessary to follow the liquid steel level in a mould. There is no way to follow the surface of liquid steel by sight, because of specificity of the mould construction and the temperature conditions during the process of the thin slab casting. Now the liquid steel level is estimated by a gamma ray method. These method have some problems with environment and human health [1].

An eddy current build-in molten metal level sensor doesn't use now. The main problem which impede of using such a sensor is an electromagnetic break and its noise.

It is necessary to create such a molten metal level sensor which will be answer the purpose of the human health and measure the molten metal level efficiently. The close standing of an opposite copper wall of the mould and the flood of the molten metal pose the problems on the way of creation the eddy current build-in molten metal level sensor.

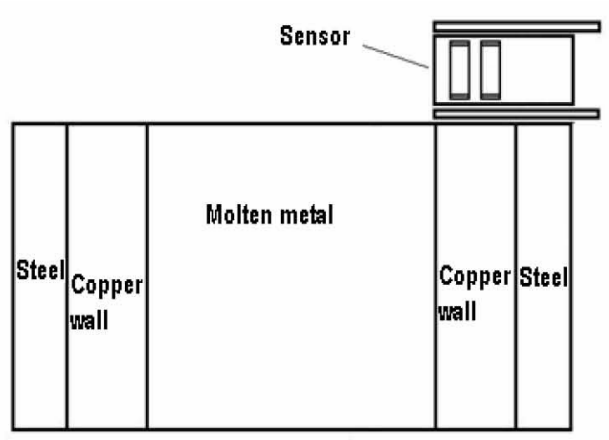

Fig. 1. Standing of molten metal level sensor on the mould

The target is to find out a method of controlling the level of the molten metal in a thin slab mould (Fig.1). In approaching this target it is necessary to find out the topography of an induction coil magnetic field, estimate the necessity of the case and determine its position relative to the induction coil and the detection coil. The method of the finite elements mentioned

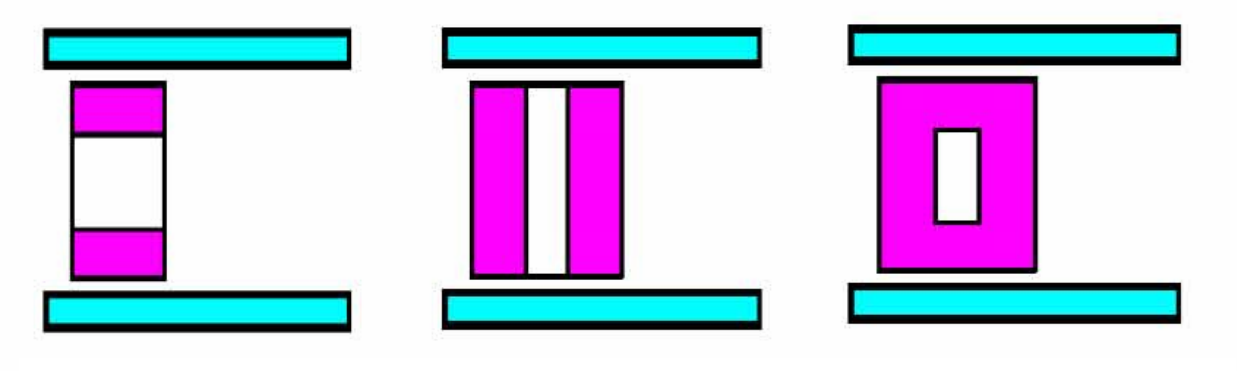

Fig.2. Three type of the induction coil of the molten metal level sensor

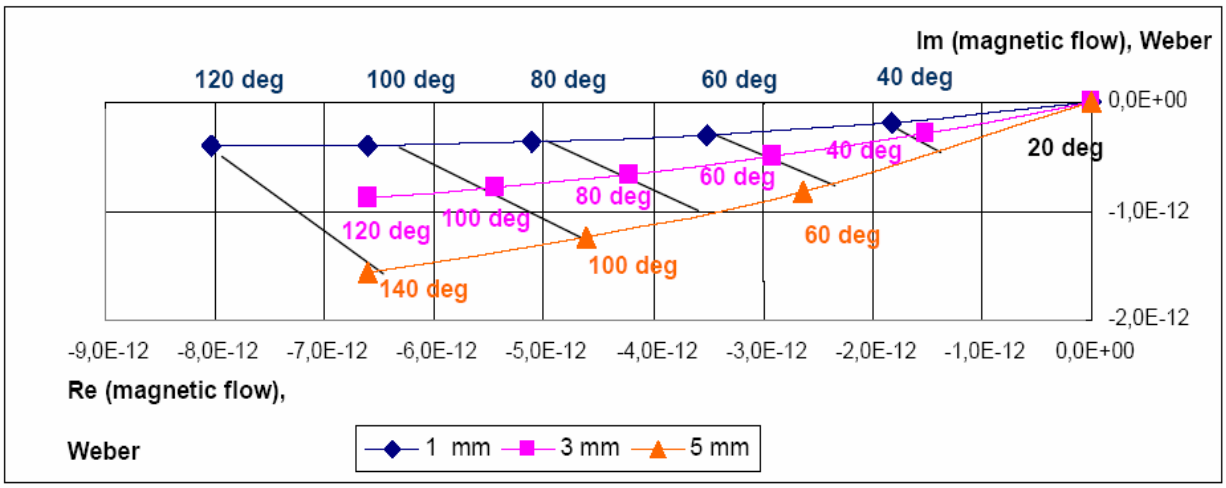

Fig. 3. Hodograph curves of magnetic flow of molten metal level sensor signal for different gaps and temperature (equivalent resistance)

at the ANSYS software, to complex is used study the topography of the magnetic field. We'll briefly review the results of the calculations for the different types of exciting coil (Fig. 2). The calculations were done with a help of the 3D final elements model of the mould with a cross-section 400x200 mm for the frequency 2500 Hz. The gap between the induction coil and the top plate of the sensor is the next what we'll consider. Fig. 3 shows a hodograph curves of the magnetic flow of the sensor for the first variant of the exciting coil (Fig. 2) and different variants of the gap between the top copper plate of the sensor case for different values of specific electric resistance of this plate.

We can see that the hodograph curve rotates counterclockwise and the signal decreases with increasing of the gap between the top plate of the sensor case and the coil. We can use [2] such an effect to prevent an influence of changing the specific electric resistance of the top plate of the sensor case on the signal from the molten metal level surface, when we have 90 degrees between the above-mentioned curves.

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